In the next two figures, 25 (B. 1697) and 26 (S. 191), growth has been delayed or temporarily suppressed along three, alternately placed, directions, yielding apparently trigonal forms, the apexes of which lie at 30° from those of the actual trigonal prisms. The symmetry around the unique axis is here threefold, but the arrangement of the directions of delayed growth with reference to the crystal axes shows that this is not an expression of the symmetry of the substance, but is essentially accidental.

A still greater number of directions of suppression or delay of growth are shown by figures 27 (B. 203-b) and 28 (B. 2503) (No. 178 of Shedd's series is another instance of the same thing); in these, four directions have been suppressed, and two opposing ones favored. In No. 27 this has occurred only in the last stages of growth; in No. 28 at a much earlier time. The result is a marked development of twofold symmetry around the unique axis. Still less symmetry is shown by figure 29 (S. 161), in which there has been a suppression of three adjacent growth directions, giving a figure possessing only bilateral symmetry with respect to one of the three like axes, placed horizontally in the figure. Figure 30 (B. 1390; also Shedd's 187) shows similar bilateral symmetry as a result of having only two growth directions suppressed, these lying 120° apart.

Interference between closely adjacent crystals is of course one effect capable of producing some of these suppressions of growth. And Mr. Bentley points out that crystals like figure 30 often show overlapping of the opposite portions, indicating that they have been subjected to some disruptive force. But the causes of these "accidents" which result in diminished symmetry can in general not be explained in detail.

Finally, a few crystals in which the unique axis is so developed that the crystallographic difference between its extremities is brought out remain to be considered. In figure 31 the tabular crystals at opposite ends of the central column are in the one case different in size, in the other different in outline as well. Figure 32 is evidently merely another illustration of a similar effect, the elongation of the unique axis being but slight. Here, however, the crystals belonging to the opposite ends have apparently pushed each other aside, so that they now lie at 30° from one another. The property of ice crystals of exhibiting gliding on the basal plane without disruption has permitted them to remain attached, and an apparent 12-rayed crystal is the result, the crystallographic dissimilarity of the opposite ends being brought out by the slightly different size of the alternate rays.

EXPLANATION OF PLATES I TO IV.

All the figures except the last two are placed with their crystallographic axes in corresponding directions, one right and left, two others crossing it at 60° angles, and the unique axis perpendicular to the paper.

Plate I.

Figure.

9 (Shedd's 174). Simple trigonal prism without apparent secondary growth.

10 (Shedd's 177). Positive with subordinate negative trigonal prisms, without apparent secondary growth (this may be present but obscured).

11 (Bentley's 1637). Positive and negative trigonal prisms in equilibrium; no apparent secondary growth, although this may be present but merely obscured, as suggested by the symmetrically arranged air bubbles near the center.

12 (S. 179). Like 10, with secondary growth beginning along six directions.

13 (B. 1749). Like 12, with secondary growth well advanced.

14 (S. 144). Like the two preceding, but with secondary growth consolidated.

Figure. *Plate II.*

15 (B. 1995). Small trigonal center, with subsequent growth showing hexagonal arrangement; interference of lateral rays also shown.

16 (S. 146). Like 15, but with secondary growth well consolidated.

17 (B. 3014). Central portion apparently hexagonal, but the crystallographic dissimilarity of alternate sides shown by the trigonal arrangement of the outermost secondary growth.

18 (S. 109). Like 17, with secondary growth well consolidated.

19 (S. 5). Trigonal center vanishingly small, and secondary growth showing hexagonal arrangement, with marked bilateral symmetry along rays.

20 (S. 84). Like 19, with secondary growth well consolidated. (The features shown by figures 19 and 20 are those of most frequent occurrence in snow crystals.)

Plate III.

21 (S. 192). Practically complete suppression of growth along two opposite lines, resulting in two-fold symmetry.

22 (B. 1209). Like 21, with secondary growth well consolidated.

23 (S. 186). Like 21 and 22 at the outset, but subsequent growth in originally suppressed directions has nearly caught up with that in the favored directions.

24 (B. 173 through oversight given as S. 173 in the plate). Like 23, but with subsequent growth so caught up and consolidated as to have complete trigonal symmetry.

25 (B. 1697). Growth delayed along three alternately placed directions, resulting in apparent trigonal symmetry.

26 (S. 191). Like 25, but with secondary growth more consolidated.

Plate IV.

27 (B. 203-b). Suppression of secondary growth along four lines, resulting in twofold symmetry.

28 (B. 2503). Like 27, but the suppression has occurred at an earlier stage.

29 (S. 161). Suppression of secondary growth along three adjacent directions, giving only bilateral symmetry on a single axis.

30 (B. 1390). Suppression of secondary growth at an early stage along two directions lying 120° apart, the result being similar to that in 29.

31 (S. 196-b). Two crystals showing crystallographic dissimilarity of the ends of the unique axis by the more extended growth of one attached plate as compared with the other.

32 (S. 184). Like the preceding, but with very short column, and with the crystal belonging to one end of it turned at 30° with respect to that belonging to the other end; crystallographic dissimilarity of the opposite ends of the unique axis distinctly shown by the difference in development of the alternate rays.

WOULD A LARGE RESERVOIR INCREASE RAINFALL?

The Central Office of the Weather Bureau recently received a request from a foreign government for an opinion as to whether it would be worth while to construct a large reservoir to affect favorably the rainfall of the immediate area in which it would be located. The climatic conditions of the region in which the construction of the proposed reservoir is being debated are rather peculiar since it is a tropical region of low rainfall and occasional severe droughts with the ocean on one side and otherwise surrounded by regions of rather abundant rainfall.

In seeking for analogous conditions in the United States the following, while not similar in all respects to those of the country in which the reservoir is proposed to be created, offered the most direct evidence. The cases considered were the creation of Salton Sea, in California, the building of dams and the reservoirs formed thereby in Minnesota and finally the probable influence of the Great Lakes on the precipitation of the Lake region.

These cases were considered briefly and the precipitation in the cases of Salton Sea and the reservoirs of Minnesota both before and after their creation was tabulated.

The average rainfall of Arizona taken from climatological data for that State shows more rain after 1906, the year that Salton Sea was formed, than before, with the exception of the dry year of 1910. The data are, however, not strictly homogeneous, since the number of reporting rainfall stations in later years was much increased and, moreover, the proximity of the Gulf of California to Arizona, a body of water vastly greater than Salton Sea even at its maximum, seems to vitiate the argument that the presence of Salton Sea materially affected the rainfall of Arizona.

In the case of Minnesota the yearly averages for a period of 32 years does not show any progressive increase in the rainfall of that State; on the contrary, the greatest deficiency in precipitation during the period occurred in 1910, several years after the completion of the reservoirs.

A consideration of the probable effect of the Great Lakes led to the conclusion that an increase of 2 or 3 inches in the annual precipitation might reasonably be ascribed to the moisture supplied by the Great Lakes.—*A. J. Henry.*

THE DESICCATION OF AFRICA.

Review reprinted from *The Geographical Journal*, Feb., 1919, vol. 53, pp. 122-123.]

Papers on the increasing aridity of areas in the south and west of Africa have recently been noticed in this *Journal* (vols. 50, p. 30, and 51, p. 404), and a recent Johannesburg publication by Prof. E. H. L. Schwarz, which we have received, dealing with the continent as a whole in the same relation, will at least be useful in bringing into prominence a variety of interesting questions, geographical, meteorological, and engineering. The evidence is held to be incontestable that the Sahara Desert within the historic period and the Kalahari Desert much more recently were well watered and thickly peopled, and that the change to present day conditions has been brought about by alterations in the river system of the continent through headstream erosion of the short, rapid coastal streams, which by cutting back into the coastal mountain rampart have captured the waters of great inland rivers. In this way, it is held, has the Niger been diverted from a straight northerly course across the Sahara, fertilizing a wide extent of border country, into the bent curve which the river describes today with disastrous consequences to northwest Africa. That local desiccation of parts of the continent is in progress as a result of its peculiar physical structure is no doubt possible, and its explanation by headstream erosion altering the drainage systems is more plausible than one which attributes it to progressive decrease of rainfall—a supposition difficult to admit on climatological principles in default of indisputable evidence. Having considered the apparent facts of desiccation and their causes, the author goes on to discuss somewhat ambitious schemes for the amelioration of climatic conditions in the waterless regions of Africa which are alleged to be steadily gaining in area in consequence of the pernicious hydrographic régime under which the continent lies. The measures outlined consist of engineering schemes for enlarging the areas of Lake Chad in the Sahara and Lake Ngami in the Kalahari to something like former dimensions. The project for North Africa of diverting Congo waters at Stanley Pool is dismissed as too costly to be feasible at the present time, but that for South Africa (to which reference was made in the *Journal* for May 1918, p. 337) is urged as being quite practicable and of pressing importance. Were we disposed to grant the possibility of creating an artificial reservoir some 15,000 square miles in area (as to which opinions will certainly differ), the author's contention that it would add greatly to the humidity of the air over South Africa and so tend to mitigate the destructive character of desert winds is no doubt sound; but one can not give unqualified assent to his further contention that the evaporation from such an inland reservoir must necessarily "supply rain clouds for the whole of South Africa," rendering sterile tracts fertile. The primary raison d'être of the African deserts, both north and south, is their location in the belt of trade winds which, whether they blow over land or sea, are rainless winds except where their course is obstructed by a range of mountains, as in the case of the Drakensberg system on the eastern side of South Africa itself. In South Africa the really droughty region with less than 10 inches of rain per annum extends from about the middle of the Bechuanaland Protectorate westward right to the shores of the Atlantic; and no estimate of the capacity of a large "evaporating dish" for increasing either the local or general rainfall of the country would be of much value that was not based upon a very intimate local knowledge (of which evidence is not produced in the paper under notice) of the precise conditions in which such rain as does fall is generated.

THE PROGRESSIVE DESICCATION OF THE COLONY OF SENEGAL.

By CHARLES RABOT.

[Abstracted from a discussion of the memoirs of Henry Hubert, Progression du dessèchement dans les régions Sénégalaises, *Annales de Géographie*, Paris, 1917, No. 148, in *La Géographie*, 1918, No. 2, pp. 111-113.]

Important researches in the variation of climate in Senegal, the French colony in West Africa, have been made by Henry Hubert. The geological deposits are of such a nature as to indicate that the climate in comparatively recent times has been wet; but the deposit of sand which covers the sandstone indicates that at present the tendency to dryness is increasing. The dry river valleys, old fords, the remains of crocodiles and fishes far inland, the decreasing distance from the mouth to the head of navigation of the rivers, and the decreasing commercial activities of the colony are current testimony of the progressive desiccation of the land. Towns which formerly were thickly populated are now deserted, sand dunes which formerly were quite permanent now show a tendency to shift, and water holes are disappearing.

The apparent advances and recessions of glaciation in the Alps within historic times, indeed in very short periods, are evidences of successive climatic changes which can be more easily manifest in the high mountains than in the plains country. Nevertheless, the relation between such periods in the Alps and the changes in Senegal can be traced, although of far less amplitude in Senegal. This would indicate that the present era of dryness may be again followed by one of wetness.—*C. L. M.*